

Review of the Draft Environmental Impact Statement for Essential Fish Habitat
Identification and Conservation in Alaska

Report of the Center of Independent Experts

Dr J Anthony Koslow
CSIRO Marine Research
Floreat, Western Australia 6014 Australia
Email: tony.Koslow@csiro.au

Executive summary

I have reviewed the Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation, in particular Appendix B, prepared by the Alaska region National Marine Fisheries Service. In the review I address several specific questions:

- 1) *Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?*

The model provides a first-order approximation of the potential impacts of fishing on EFH in the Alaska region, based on available data on fishing effort, habitats and habitat recovery times. However the model does not contain data on the fine-scale distribution of fishing effort with respect to particular habitat types, so it needs to be validated and interpreted in conjunction with field studies. Although the Alaska regional laboratory, particularly scientists in Auke Bay, are carrying out a highly relevant and promising field program, there appeared to be little integration of field and modelling studies. The model, based on simple ecological dynamics, must be used with caution. In particular it does not contain the possibility of irreversible change, which may occur on heavily trawled grounds.

The DEIS appeared to be based on a limited review of the scientific literature on the ecological role of EFH in the life history of commercial species and the potential impacts of fishing. Many, if not most, key recent papers and scientists working in this field were not cited, and there was a general under-appreciation of the ways that comparable species elsewhere in the world utilize comparable benthic habitats to foster their feeding, growth and survival.

- 2) *Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature?*

The primary criterion used to assess whether fishing is adversely affecting EFH in a more than minimal and non-temporary way was to assess whether any stocks were falling below their Minimum Stock Size Threshold (MSST). This is not an appropriate criterion: it may be triggered only after severe non-temporary degradation to EFH (of particular concern, coral and sponge grounds may require centuries to recover); and the role of habitat loss may be difficult to separate from other potential causes of declining fish stocks (e.g. climate change, direct effects of fishing). The direct effects of fishing on EFH can and should be observed and evaluated directly, through integrated field and modelling studies. Observer data on bycatch, not presently utilized in the DEIS, may provide a valuable complementary dataset that needs to be properly analysed. Impacts on localized habitats are not presently considered in the DEIS but the progressive degradation of localized EFH is clearly the way by which fishery productivity may be eroded.

Beyond several technical improvements to the model, I suggest that development and use of the model be closely integrated with ongoing field studies as the primary tools in determining areas of EFH in Alaskan waters and the potential impacts of fishing.

Introduction

Background

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other measures to promote the conservation and enhancement of EFH. The National Marine Fisheries Service (NMFS) and the North Pacific Fishery Management Council recently developed a draft environmental impact statement (DEIS) to consider the impacts of incorporating new EFH provisions into the Council's fishery management plans. The DEIS evaluates three actions: (1) describing and identifying EFH for fisheries managed by the Council; (2) adopting an approach for the Council to identify Habitat Areas of Particular Concern within EFH; and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. Most of the controversy surrounding the level of protection needed for EFH concerns the effects of fishing on sea floor habitats. Substantial differences of opinion exist as to the extent and significance of habitat alteration caused by bottom trawling and other fishing activities. Although an increasing body of scientific literature discusses the effects of fishing on habitat, there is no consensus within the scientific community on an appropriate methodology for analysing potential adverse effects.

The national EFH regulations (50 CFR 600.815(a)(2)) require an evaluation of the effects of fishing on EFH, and this evaluation appears in Appendix B to the DEIS. The evaluation has two components: a quantitative mathematical model to show the expected long term effects of fishing on habitat, and a qualitative assessment of how those changes affect fish stocks. The model estimates the proportional reductions in habitat features relative to an unfished state, assuming that fishing will continue at the current intensity and distribution until the alterations to habitat and the recovery of disturbed habitat reach equilibrium. The model provides a tool for bringing together all available information on the effects of fishing on habitat, such as fishing gear types and sizes used in Alaska fisheries, fishing intensity information from observer data, and gear impacts and recovery rates for different habitat types. Due to the uncertainty regarding some input parameters (e.g., recovery rates of different habitat types), the results of the model are displayed as point estimates as well as a range of potential effects.

After considering the available tools and methodologies for assessing effects of fishing on habitat, the Council and its Scientific and Statistical Committee concluded that the model incorporates the best available scientific information and provides a good approach to understanding the impacts of fishing activities on habitat. Nevertheless, the model and its application have many limitations. Both the developing state of this new model and the limited quality of available data to estimate input parameters prevent drawing a complete picture of the effects of fishing on EFH. The model incorporates a number of assumptions about habitat effect rates, habitat recovery rates, habitat distribution, and habitat use by managed

species. The quantitative outputs of the analysis may convey an impression of rigor and precision, but the results actually are subject to considerable uncertainty.

One major limitation of the model is that it does not consider the habitat requirements of managed species or the distribution of their use of habitat features. Therefore, DEIS analysts were asked to use the model output to address whether continued fishing at the current rate and intensity is likely to alter the ability of a managed species to sustain itself over the long term. In other words, are the fisheries, as they are currently conducted, affecting habitat that is essential to the welfare of each managed species? To help answer that question, the analysts considered available information about the habitats used by managed species. The analysts also considered the ability of each stock to stay above its minimum stock size threshold (MSST), after at least thirty years of fishing at equal or higher intensities. MSST is the level below which a stock is in jeopardy of not being able to produce its maximum sustainable yield on a continuing basis.

The DEIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because there is no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The DEIS finds that no Council-managed fishing activities have more than minimal and temporary adverse effects on EFH, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act. Additionally, the analysis concludes that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH. These findings suggest that no additional management actions are required pursuant to the EFH regulations.

Terms of Reference

Given the context of the Magnuson-Stevens Act requirements and the EFH regulations, the Center for Independent Experts (CIE) appointed reviewers were asked to address the following issues:

1. Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?
2. Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature? (For purposes of this question, the terms “temporary” and “minimal” should be interpreted consistent with the preamble to the EFH regulations: “Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.”) To answer this question, the panel shall address at least the following issues:
 - a. Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species’ contribution to a healthy ecosystem?
 - b. Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support

managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?

3. What if any improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?

Panel membership

The panel consisted of six persons:

- Dr Ken Drinkwater (Institute of Marine Research, Norway) (Chair)
- Dr Tony Koslow (CSIRO Marine Research, Perth, Australia)
- Dr Pierre Pepin (Department of Fisheries and Oceans, St. Johns, Canada)
- Dr Ken Frank (Department of Fisheries and Oceans, Halifax, Canada)
- Dr Paul Snelgrove (Memorial University, St. Johns, Canada)
- Dr Asgeir Aglen (Institute of Marine Research, Norway)

The panel meeting

The panel met with Drs Jeff Fujioka, Craig Rose, Jon Kurland, Anne Hollowed and other members of the Alaska Fisheries Science Center at the National Marine Fisheries Service laboratory at 7600 Sandpoint Way in Seattle on June 29, 2004. The following day the panel met in executive session, prior to preparing its reports.

Acknowledgements

The panel acknowledges the cooperation of the scientists at the Alaska Fisheries Science Center and above all, Manoj Shrivani for his diligence and efficiency in organizing the review.

Description of review activities

I reviewed the following materials:

- The Executive Summary from the *Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska* (11 pages plus tables and figures);
- The evaluation of fishing activities that may adversely affect EFH (Appendix B to the DEIS; 76 pages plus tables and figures);
- EFH sections of the minutes of the Council's Scientific and Statistical Committee meetings in October 2002, December 2002, February 2003, April 2003, June 2003, and October 2003 (each is approximately 2 pages);
- Section 303(a)(7) of the Magnuson-Stevens Act;
- Pertinent excerpts from the NMFS regulations for EFH (50 CFR 600.10 and 600.815(a)(2)) and the associated preamble (67 FR 2354-2355);
- Pertinent excerpts from the Magnuson-Stevens Act National Standard 1 Guidelines (50 CFR 600.310(d)); and
- Selected public comments on the DEIS that are pertinent to Appendix B, including criticisms of the analytical approach (comments to be selected by NMFS after the close of the public comment period on April 15, 2004).

In addition I reviewed papers referred to in the DEIS and in the selected public comments related to benthic communities in the Alaska region and the impacts of trawling. I also brought to bear on the review scientific literature from studies elsewhere in the world on the impacts of trawling on benthic communities. I did not attempt a systematic review; rather I depended on key studies familiar to me from my own research. I list these in the bibliography.

Summary of findings

1. *Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?*

The NMFS model provides an important tool for understanding the effects of fishing on benthic habitat in Alaska. It provides a means to bring together considerable spatial data on fishing effort and habitat type, along with estimates of habitat recovery times, to provide first-order estimates of fishery impacts on several broad categories of benthic habitat type.

However the model is not adequate in and of itself to understand the impacts of fishing for the following reasons:

- Benthic community dynamics are not included in the model, i.e. issues such as potential species succession (shifts to more opportunistic species under increased fishing pressure) and changes in diversity.
- The model does not incorporate data on benthic habitat potentially available from trawl surveys, observer data and benthic habitat mapping.
- The model does not appear to have integrated data from a range of field studies carried out in Alaskan waters that have investigated benthic community structure, dynamics and the impacts of trawling.
- The diverse global scientific literature on the impacts of trawling on comparable benthic habitats has not been used to validate the model or to

extend our understanding of potential impacts, particularly where there is considerable uncertainty.

- Field experiments to test and validate model predictions have not been carried out, although area closures appear to present excellent opportunities.

It is therefore critical that results of the model are supplemented with results from regional and global field studies to develop the best possible understanding of the likely impacts of trawling on the region's EFH. This has been an extremely active area of research over the past decade. There is now a diverse literature, including several excellent reviews, that has considerably increased our understanding of the impacts of trawling on physical and biogenic structures across a range of habitats, and the subsequent impacts on fisheries ecology and ecosystem structure and function.

A review of this literature was carried out as part of the DEIS (Chapter 3), which was supplied to the panel during the review meeting. The review covered many recent papers, but neglected a surprising number of key studies and reviews. Indeed environmental groups present at the review meeting provided me with a list of 198 papers on the impacts of fishing that were not cited or utilized in the DEIS. I have not attempted a review of the literature myself nor have I listed all relevant studies known to me that were omitted from the DEIS. However I have listed in the bibliography the particularly critical studies in this field that I used in my assessment, most of which were not cited. In fact, many of the leading scientists working in the field were not cited (e.g. Auster, Collie, Dayton, de Groot, Fossa, Gislason, Hall, Hutchings, Jennings and Kaiser), as well as several important studies from the Alaska region (Freese 2003, Krieger 2001, Witherell and Coon 2001, Stone 2004). My confidence in the review was not enhanced by finding that the reference to my own work was both mis-cited (Koslow and Gowlett-Holmes 1998 cited as Koslow and Garrett-Holmes 1995) and referred to an agency report rather than the peer-reviewed publication (Koslow et al. 2001).

My concern here is not simply that the DEIS contains a less-than-adequate literature review, but that key issues that have emerged in recent studies are not recognized or sufficiently appreciated. Although concern about the impacts of trawling has a venerable history, extending back to the 14th century (de Groot 1984), scientific interest is relatively recent. Because trawling is such an ancient and widespread fishing practice, well-designed (e.g. BACI) studies are extremely difficult and rare. The scientific literature must therefore be perused carefully. Lack of proof for a particular impact cannot be taken for proof of a lack of impact, and one must look more widely than in one's own backyard. The following issues need to be more fully assessed and incorporated into the DEIS analysis:

- *Trawling impacts on benthic community structure and biodiversity:* A sharp distinction is often made between trawling impacts on hard and soft bottoms. Trawling impacts on the corals that dominate hard-bottom benthic communities are generally accepted to be extremely long-lived (on the order of centuries, at least), whereas soft-bottom communities are considered to be highly resilient, with recovery times on the order of several years. The model in Appendix B views benthic communities as if they were single populations, for which simple intrinsic rates of mortality and growth (or fishing impact and recovery rate) can be specified. The community is expected to reach an equilibrium, given a particular level of fishing. In fact, however, benthic communities, even on relatively soft bottoms, are diverse and complex. Studies on Georges Bank have shown that trawling leads not only to reduced benthic biomass and diversity, but a shift in community structure and habitat

complexity: from 'bushy' epifauna (e.g. bryozoans, hydroids, worm tubes) that provide complex habitat for shrimps, polychaetes, brittle stars and small fish, to sites dominated by hard-shelled molluscs, scavenging crabs and echinoderms (Collie et al. 1997, 2000). Intensively fished areas are likely to be maintained in a permanently altered state, inhabited by only those organisms adapted to frequent disturbance (de Groot 1984, Jones 1992, Collie et al. 2000).

There are now data from the Alaska region to show that trawling has significant impacts on both soft and hard-bottom benthic communities. McConnaughey et al (2000) observed reduced diversity and abundance of biogenic structures (e.g. anemones, soft corals, sponges, bryozoans, ascidians) in heavily fished areas of the eastern Bering Sea. Freese et al (1999) demonstrated the short-term impacts of trawling on physical and biogenic structures in hard-bottom benthic environments utilized by Atka mackerel and several rockfishes.

- *Impacts on commercial species:* Since the 1980s, an extensive literature has developed on how commercial fish and crustacean species utilise biogenic and physical benthic habitat structure, and how its removal, such as by trawling, may decrease forage species and juvenile growth and increase mortality through predation (see papers and reviews by Bradstock and Gordon 1983, Auster et al. 1996, Auster and Langton 1999, Collie et al. 1997, Thrush and Dayton 2002, and further references therein). Juvenile commercial species have been shown to utilise three-dimensional benthic habitat structure, such as created by bryozoans and other 'coral-like' organisms, such that mortality is reduced in these habitats. These structures also provide habitat for shrimps and other fish forage. Fishes have been shown to aggregate in deepwater corals, and fishermen report reduced catches where these corals have been damaged by trawling (Fossa et al 2002).

This literature is virtually ignored in the DEIS. Although I know of no studies from the Alaska region that have examined the links between benthic habitat structure and the feeding, growth and survival of commercial species, a number of studies have been conducted on closely related and ecologically similar species (e.g. gadids such as Atlantic cod; *Sebastes* spp) inhabiting similar benthic habitats in the North Atlantic. *The weight of scientific evidence indicates that these benthic habitats on both hard and soft bottoms in the Alaska region should be considered essential fish habitat, in the sense of the Magnuson-Stevens Act.*

I conclude that the DEIS does not incorporate the best available scientific information and does not provide an adequate basis for understanding the impacts of fishing on essential fish habitat in Alaska.

2. *Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature?*
 - a. *Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species' contribution to a healthy ecosystem?*

The model developed in Appendix B provides a rough first-order approach to assessing the impact of trawling on benthic communities in Alaskan waters. Of greatest concern were model results indicating that on the order of 50 – 100% of coral habitat may be removed in particular areas. The recovery rate of sponge habitat may also be greatly underestimated, as noted in the submission by Shester and confirmed by studies on the Northwest Shelf of Australia (Sainsbury 1997).

As noted in the DEIS, the fine-scale distribution of fishing effort is not known, so the actual impact on particularly sensitive habits, such as corals and sponges, may be significantly biased upwards or downwards, depending on whether trawlers avoid or focus effort on those habitats. The statement (and apparent assumption) in the DEIS that impact is probably biased upward is a matter of concern. Where deepwater fishes aggregate in such sensitive habitats (e.g. orange roughy on seamounts), fishing effort typically soon follows, facilitated by improvements in fishing technology. The development of rock-hopper gear, GPS, track-plotters, net sondes and so on enables trawlers to advance continually into grounds once considered untrawable.

Levels of coral, sponge and bryozoan bycatch in the Alaskan trawl fisheries, particularly in the Aleutian region, based on observer records are a matter of concern, but these data were not analysed or incorporated into the model formulation or validation process. Anderson and Clark (2003) show that coral bycatch from new orange roughy fishing grounds declined sharply after the first year of fishing. The continued coral and sponge bycatch from certain segments of the Alaskan trawl fisheries may therefore indicate continued advance of the fleet into previously unfished grounds containing sensitive habitat. There is an urgent need to address this issue through analysis of catch and effort data, observer bycatch data, field studies and consultation with the industry.

My single greatest concern in the DEIS is its use of MSST as the major criterion for assessing the potential impact of fishing on EFH. This is completely inappropriate, particularly with regard to the impact of fishing on sensitive habitats, such as corals and sponges, where any impact is unlikely to be temporary and estimated potential impacts > 50% cannot be regarded as minimal. Clearly the primary criterion for unsustainable impact on EFH must be the impact on the habitat itself, as indicated by field surveys and modelling.

The MSST criterion is altogether too insensitive to be used as the major criterion for assessing unsustainable impacts on EFH. First, a decline in stock sustainability below MSST would likely only occur after extensive and irreversible damage to EFH occurs. Second, even at such a point the link between a decline in fishery sustainability and EFH may still be exceedingly difficult to prove because alternative hypotheses (eg. impacts of climate change or of fishing itself) will always be available (This was observed at the review, when Dr Hollowed attributed declining recruitment in certain stocks to climatic regime shifts rather than to potential changes in EFH.). For these reasons, in areas of particularly sensitive habitat such as corals and sponges, a more precautionary approach is warranted, based primarily on the direct impacts to the habitats themselves, rather than to second-order impacts on the fisheries.

- b. Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?*

The DEIS, in its reliance on the MSST criterion, virtually excludes any consideration of localized habitat impacts. This is a matter of considerable concern, since EFH and the potential productivity of commercial species may be considerably eroded before a species falls below its MSST. Indeed the aim of the Magnuson-Stevens Act is presumably to prevent just such incremental degradation of ecosystem sustainability. The remedy seems clearly to replace the MSST criterion with consideration of fishery impact on the EFH itself as the primary criterion.

There is an urgent need for areas of critical habitat to be mapped and baselines established. Observer data on effort and bycatch may provide insight into whether the spatial distribution of fishing effort has shifted over time into areas of particularly sensitive habitat.

3. *What if any improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?*

These are two questions. The first question—how the model may be improved—is primarily technical. I suggest here, as have some submissions, that the model incorporate a longer recovery time for sponge habitat. I also suggest that the model incorporate a different function, such that recovery becomes increasingly prolonged and uncertain past a certain critical point. This is to take account of the conclusion of Collie et al. (2000) that ‘areas that are fished in excess of three times per year (as occurs in parts of the North Sea and Georges Bank) are likely to be maintained in a permanently altered state.’

The second question relates to the application of the model in the context of the DEIS. At present, the model provides a useful first-order assessment of the scale of trawling impacts by area and as a function of habitat type. The DEIS then makes little further use of the model results, insofar as the MSST criterion is then applied as the primary criterion for assessing whether there are significant fishery impacts on EFH.

As I have indicated previously, fishery impacts on EFH itself, whether localized or widespread, must be the primary criterion for determining whether the impacts are minimal and temporary, or not. The model can be used to direct attention to areas and habitats of particular concern, where field research needs to be focussed to address these issues.

It needs to be emphasised that research on the impacts of trawling on EFH—and indeed on determining how particular habitats function as EFH—is extremely recent. The tools for direct visual observation have only recently become available, and experimental research designs have only recently been applied to these questions. The development of this science in Alaskan waters is in its infancy, although early results are extremely promising. McConnaughey et al (2000) documented fishery impacts on the biogenic structure on soft-bottom seafloor in the Alaska region only several years ago; how these impacts influence regional fisheries is still largely unknown. The region’s deep-sea coral ‘gardens’ are at a much earlier stage of exploration: their distribution, diversity and ecological role are still poorly documented, although there are indications that they may be exceptionally diverse and abundant (Stone 2004). There is also evidence of limited fishery impacts (Stone 2004). It is a matter of urgent priority that these areas be protected while research is undertaken to map their distribution and to assess their diversity and ecological role. At this early stage, lack of knowledge cannot be mistaken for lack of impact or for

evidence that particular benthic habitats do not function as EFH, particularly when evidence from comparable ecosystems indicates otherwise.

Conclusions/Recommendations

In conclusion, my primary findings are:

- The review of the literature underlying the DEIS was inadequate. The study of EFH is a rapidly expanding field of research. Improved experimental designs and newly-available research tools are dramatically enhancing our appreciation of how commercial species utilize benthic habitats to enhance their feeding, growth and survival, and of how fishing may impact such EFH. Most of the leading researchers and key recent papers in this field are not cited in the DEIS and their results not incorporated. As a result there appears to be an insufficient appreciation in the DEIS of the roles that biogenic structures on both soft and hard benthic environments in the Alaska region may play in the ecology of commercial species.
- The model provides a good first-order approximation of how Alaskan trawl fisheries may impact EFH by sub-region and habitat. However the recovery time for many sponge habitats appears to be significantly underestimated and the potential for more-or-less permanent habitat alteration at high levels of fishery impact is not incorporated into the model.
- The excellent field research programs on Alaskan regional fishery habitats were not adequately utilized to address issues of EFH and fishery impacts. Long-term observer data on fishing effort and bycatch should also be analysed to assess spatial patterns of fishing and potential impacts on EFH.
- The use of MSST is inappropriate as a primary criterion to assess fishery impacts on EFH. It is altogether too insensitive, since massive and virtually irreversible damage to some habitats (e.g. coral and sponge gardens) may occur before species decline below their MSST. It is also inappropriate because of the difficulty of definitively determining that fishery declines below MSST are due to losses in EFH versus the impacts of climate change or of the fishery itself.

Recommendations

- The modelling and field research programs need to be more closely integrated—each informing the other—as the primary tools for assessing the roles of benthic habitats in fishery production and the impacts of fishing on them.
- A more precautionary approach should be adopted, such that research from comparable habitats and on similar species is used to denote initially the likely regions of EFH in the Alaska region. Research closures or other precautionary management measures (e.g. Alternative 5b) should be utilized to protect potential EFH while research is carried out to assess these habitats, their ecological role, and the impacts of fishing.
- MSST should be dropped as a criterion of impact on EFH, or at most used only to provide evidence of the most drastic impacts.

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http://www.afsc.noaa.gov/abl/MarFish/coral_gardens_video.htm

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APPENDIX I: STATEMENT OF WORK

Statement of Work

Consulting Agreement between the University of Miami and Dr. Tony Koslow

Background

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other measures to promote the conservation and enhancement of EFH. NMFS and the North Pacific Fishery Management Council recently developed a draft environmental impact statement (DEIS) to consider the impacts of incorporating new EFH provisions into the Council's fishery management plans. The DEIS evaluates three actions: (1) describing and identifying EFH for fisheries managed by the Council; (2) adopting an approach for the Council to identify Habitat Areas of Particular Concern within EFH; and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. Most of the controversy surrounding the level of protection needed for EFH concerns the effects of fishing on sea floor habitats. Substantial differences of opinion exist as to the extent and significance of habitat alteration caused by bottom trawling and other fishing activities. Although an increasing body of scientific literature discusses the effects of fishing on habitat, there is no consensus within the scientific community on an appropriate methodology for analyzing potential adverse effects.

The national EFH regulations (50 CFR 600.815(a)(2)) require an evaluation of the effects of fishing on EFH, and this evaluation appears in Appendix B to the DEIS. The evaluation has two components: a quantitative mathematical model to show the expected long term effects of fishing on habitat, and a qualitative assessment of how those changes affect fish stocks. The model estimates the proportional reductions in habitat features relative to an unfished state, assuming that fishing will continue at the current intensity and distribution until the alterations to habitat and the recovery of disturbed habitat reach equilibrium. The model provides a tool for bringing together all available information on the effects of fishing on habitat, such as fishing gear types and sizes used in Alaska fisheries, fishing intensity information from observer data, and gear impacts and recovery rates for different habitat types. Due to the uncertainty regarding some input parameters (e.g., recovery rates of different habitat types), the results of the model are displayed as point estimates as well as a range of potential effects.

After considering the available tools and methodologies for assessing effects of fishing on habitat, the Council and its Scientific and Statistical Committee concluded that the model incorporates the best available scientific information and provides a good approach to understanding the impacts of fishing activities on habitat. Nevertheless, the model and its application have many limitations. Both the developing state of this new model and the limited quality of available data to estimate input parameters prevent drawing a complete picture of the effects of fishing on EFH. The model incorporates a number of assumptions about habitat effect rates, habitat recovery rates, habitat distribution, and habitat use by managed species. The quantitative outputs of the analysis may convey an impression of rigor and precision, but the results actually are subject to considerable uncertainty.

One major limitation of the model is that it does not consider the habitat requirements of managed species or the distribution of their use of habitat features. Therefore,

DEIS analysts were asked to use the model output to address whether continued fishing at the current rate and intensity is likely to alter the ability of a managed species to sustain itself over the long term. In other words, are the fisheries, as they are currently conducted, affecting habitat that is essential to the welfare of each managed species? To help answer that question, the analysts considered available information about the habitats used by managed species. The analysts also considered the ability of each stock to stay above its minimum stock size threshold (MSST), after at least thirty years of fishing at equal or higher intensities. MSST is the level below which a stock is in jeopardy of not being able to produce its maximum sustainable yield on a continuing basis.

The DEIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because there is no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The DEIS finds that no Council-managed fishing activities have more than minimal and temporary adverse effects on EFH, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act. Additionally, the analysis concludes that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH. These findings suggest that no additional management actions are required pursuant to the EFH regulations.

Expertise Needed for the Review

The review panel shall comprise six individuals. Panelists shall have expertise in benthic ecology, fishery biology, fishing gear technology, ecological modeling, and/or closely related disciplines.

Information to be Reviewed

The CIE panel shall review the following materials:

- The Executive Summary from the *Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska* (11 pages plus tables and figures);
- The evaluation of fishing activities that may adversely affect EFH (Appendix B to the DEIS; 76 pages plus tables and figures);
- EFH sections of the minutes of the Council's Scientific and Statistical Committee meetings in October 2002, December 2002, February 2003, April 2003, June 2003, and October 2003 (each is approximately 2 pages);
- Section 303(a)(7) of the Magnuson-Stevens Act;
- Pertinent excerpts from the NMFS regulations for EFH (50 CFR 600.10 and 600.815(a)(2)) and the associated preamble (67 FR 2354-2355);
- Pertinent excerpts from the Magnuson-Stevens Act National Standard 1 Guidelines (50 CFR 600.310(d)); and
- Selected public comments on the DEIS that are pertinent to Appendix B, including criticisms of the analytical approach (comments to be selected by NMFS after the close of the public comment period on April 15, 2004).

Panelists should refer to the following website to access all background material.

<http://www.fakr.noaa.gov/habitat/cie/review.htm>

Questions to be Answered

Given the context of the Magnuson-Stevens Act requirements and the EFH regulations, the CIE reviewers shall address the following issues:

1. Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?
2. Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature? (For purposes of this question, the terms “temporary” and “minimal” should be interpreted consistent with the preamble to the EFH regulations: “Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.”) To answer this question, the panel shall address at least the following issues:
 - a. Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species’ contribution to a healthy ecosystem?
 - b. Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?
3. What if any improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?

Review Process, Deliverables, and Schedule

The review panel shall consist of six members, one of whom shall serve as the Chair, as specified below.

Duties of the Panelists

1. Each panelist shall attend in person and participate in a one-day meeting with the scientists who developed the fishing-effects model and the analytical approach used to evaluate the effects of fishing in the DEIS. The meeting will be held at the Alaska Fisheries Science Center in Seattle on June 29, 2004. The meeting will be open to the public to attend, but there will be no opportunity for public testimony. The lead authors of the model, Dr. Jeffrey Fujioka and Dr. Craig Rose, will provide an overview of the model, how it was developed, how it was refined in response to comments from the Council’s Scientific and Statistical Committee and other reviewers, and how it was used in the DEIS. The panel will have an opportunity to question Dr. Fujioka and Dr. Rose, as well as Dr. Anne Hollowed, who assisted in designing the analytical approach used to evaluate the effects of fishing in the DEIS. The panel shall meet in executive session at the Alaska Fisheries Science Center on

June 30, 2004 to discuss the information presented, and to identify any unanswered questions.

2. Prior to the meeting, each panelist shall review the materials specified above. Panelists may submit written questions via e-mail to Jon Kurland (Jon.Kurland@noaa.gov), with copies to the Contracting Officer's Technical Representative (COTR), Stephen Brown (Stephen.K.Brown@noaa.gov), and to the CIE manager, Manoj Shivlani (mshivlani@rsmas.miami.edu) at least two weeks before the meeting to ensure topics of particular interest will be covered during the presentation.
3. Each panelist shall deliver an individual final written report containing answers to the questions posed above and any recommendations. These individual reports shall be submitted the Chair and to Dr. David Die of the University of Miami via e-mail at ddie@rsmas.miami.edu, and to Mr. Manoj Shivlani via email at mshivlani@rsmas.miami.edu no later than July 15, 2004. The reports shall include the following sections: executive summary, background, description of review activities, summary of findings, conclusions/recommendations, bibliography of any materials relied upon by the panel, and a copy of this statement of work. Please refer to the following website for additional information on report generation: http://www.rsmas.miami.edu/groups/cimas/Report_Standard_Format.html.